

CLAIMS

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1. Method for the plasma-based generation of X-radiation, with the steps:

- provision of a target material (50) in the form of a free flow structural formation (51) in a vacuum chamber (20), and
- 10 - irradiation of the target material (50) in order to produce a plasma condition in which the X-radiation is radiated therefrom,

characterized, in that

- the flow structural formation (51) is formed in such a way
- 15 that the target material, at least at a location of irradiation, has a surface (52) with a local curvature minimum.

2. Method according to Claim 1 in which the flow structural formation (51) has, at least at the location of the irradiation, a cross-sectional surface having in a main axis direction (y) a longitudinal expansion Δy that is larger than a transverse expansion Δx in an auxiliary axis direction (x) deviating from the main axis direction (y).
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- 25 3. Method according to Claim 2 in which the flow structural formation (51) has, at least at the location of the irradiation, an oval cross-sectional surface or a rounded-off, rectangular cross-sectional surface.

- 30 4. Method according to Claims 2 or 3 in which the flow structural formation (51) forms, at least at the location of the irradiation, a free lamella-type sheet.

5. Method according to Claims 3 or 4 in which the flow structural formation (51) has, at least at the location of the irradiation, a concave surface at least on one side.
- 5 6. Method according to at least one of the preceding Claims where the flow structural formation (51) of the target material is produced with a target source which has a nozzle with a non-circular outlet opening (14).
- 10 7. Method according to Claim 6 where the flow structural formation (51) of the target material is produced with a dispenser which has a nozzle with a slot-shaped outlet opening (14).
- 15 8. Method according to Claims 6 or 7 where the nozzle for setting a predetermined alignment relative to the direction of the irradiation of the target material (50) is rotated.
9. Method according to at least one of the preceding Claims 1
20 to 4 in which the flow structural formation (51) of the target material is produced with two primary jets which are led together for the formation of a free self-supporting liquid sheet at a predetermined angle.
- 25 10. Method according to Claim 9 in which the primary jets are led together at an angle that is smaller than or equal to 180°.
11. Method according to Claim 9 in which the primary jets are
30 led together at an angle that is smaller than or equal to 90°.

12. Method according to at least one of the preceding Claims in which the flow structural formation (51) of the target material is irradiated essentially perpendicular onto the surface (52) with the local curvature minimum.

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13. Method according to at least one of the preceding Claims in which one of the following materials is used as target material: at least one hydrocarbon compound comprising at least one polymer, which is liquid at ambient temperature, water, glycerine, alcohol, liquefied gas or liquid metal.

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14. Method according to Claim 13 in which the hydrocarbon compound used as target material has at least one ether binding between carbon atoms.

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15. Method according to Claim 14 in which the hydrocarbon compound used as target material has at least one partially fluorinated or perfluorinated polymer hydrocarbon ether.

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16. Method according to Claim 15 in which the hydrocarbon compound used as a target material has a perfluoropolyether or a mixture of perfluoropolyethers.

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17. Method according to at least one of the Claims 13 to 16 in which the hydrocarbon compound used as target material has a vapor pressure at ambient temperature less than 10 mbar, a molecular weight larger than 100 g/mol and/or a viscosity in the range of 1 cS to 1800 cS.

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18. Method according to one of the preceding Claims 13 to 17, in which the irradiation of the target material (50) takes place in a vacuum chamber (20) which is at least locally heated in such a way that the vapor pressure of the target

material (50) is higher than the pressure of the gas, which is released by the irradiation of the target material (50).

19. Method according to one of the preceding Claims 13 to 18
5 in which target material (50), after irradiation, is collected in a collection device (40) at ambient temperature.

20. Usage polymer hydrocarbon compounds, which are liquid at ambient pressure, for the provision of target material in the
10 form of a flow structural formation (51), the target material having, at least at the location of a irradiation for the generation of soft X-radiation, a surface with a local curvature minimum.

15 21. Usage of partially fluorinated or perfluorinated polymer hydrocarbon ethers for the provision of target material in the form of a flow structural formation (51), the target material having, at least at the location of a irradiation for the generation of soft X-radiation, a surface with a local
20 curvature minimum.

22. X-ray source for plasma-based generation of X-radiation by means of high-energetic irradiation of a target material (50) in the form of a free flow structural formation (51),
25 comprising:

- a target source (10) that provides the target material (50) in a vacuum chamber (20), and
- an irradiation device (30) for irradiation the target material (50) in the vacuum chamber,

30 **characterized, in that**

- the target source is adapted for forming the target material in such a way that the target material in the flow structural formation (51) has, at least at the location of the irradiation, a surface with a local curvature minimum.

23. X-ray source according to Claim 22 in which the target source has a nozzle (13) with a non-circular outlet opening (14).

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24. X-ray source according to Claim 23 in which the target source has a nozzle (13) with a slot-shaped outlet opening (14).

10 25. X-ray source according to Claim 24 in which the target source has a nozzle (13) with an outlet opening (14) which is elliptic, rectangular, or convex and tapered towards the inside.

15 26. X-ray source according to Claim 24 in which the nozzle (13) has an outlet opening (14) with a nozzle slot (14a) and a conical opening (14b).

20 27. X-ray source according to at least one of the Claims 23 to 26 in which the nozzle (13) in the vacuum chamber (20) is arranged in a rotary manner.

25 28. X-ray source according to Claim 22 in which the target source has two nozzles (15, 16) for the production of primary jets, which are led together for the formation of a free self-supporting liquid sheet (51) at a predetermined angle.

30 29. X-ray source according to Claim 28 in which the nozzles (15, 16) are aligned in such a way that the primary jets are led together at an angle of 180° .

30. X-ray source according to Claim 28 in which the nozzles (15, 16) are aligned in such a way that the primary jets are

led together at an angle that is smaller than or equal to 90°.

31. X-ray source according to at least one of the Claims 22
5 to 30 in which at least one heating device (60) is provided with which at least parts of the vacuum chamber (20) can be tempered.

32. X-ray source according to Claim 31 in which the heating
10 device (60) comprises several thermostats (61-64), which are connected with components at and/or in the vacuum chamber (20).

33. X-ray source according to Claim 32 in which the irradiation
15 device has an irradiation optical system, which is arranged in the vacuum chamber (20) and is connected to a thermostat (63).

34. X-ray source according to at least one of the Claims 22
20 to 32 in which the irradiation device has an irradiation optical system which is arranged outside of the vacuum chamber (20).

35. X-ray source according to at least one of the Claims 22
25 to 34 in which a collection device (40) is provided for collecting the target material (50) after irradiation and is set up for the coolant-free operation.

36. X-ray source according to at least one of the Claims 22
30 to 35 in which an X-ray lithography device (70) is arranged in the vacuum chamber (20).

37. X-ray source according to Claim 36, in which the X-ray lithography device (70) is connected with a thermostat (64).

38. X-ray source according to at least one of the Claims 22 to 37, in which the vacuum chamber (20) is joined to a processing chamber (26) in which an X-ray lithography device (70) is arranged.

39. Vacuum chamber with a nozzle (13) with a slot-shaped outlet opening (14) for injecting liquid target material into the vacuum chamber.

40. Vacuum chamber according to Claim 39 in which the nozzle (13) is arranged in a rotating manner around an axis that runs parallel to the direction of the injection of the liquid target material.

41. Method for the injection of a liquid target material (50) in the form of a free flow structural formation (51) into a vacuum chamber (20)

characterized, in that

the flow structural formation (51) is formed in such a way that the target material has a surface (52) with a local curvature minimum.

42. Method according to Claim 41 in which the flow structural formation (51) forms a free, lamella-shaped sheet.

43. Method according to Claim 41 or 42 in which the flow structural formation (51) has a concave surface (52) at least on one side.